Geophysical Research Abstracts
Vol. 14, EGU2012-13687, 2012
EGU General Assembly 2012

Expected fluid residence times, thermal breakthrough, and tracer test design for characterizing a hydrothermal system in the Upper Rhine Rift Valley

I. Ghergut (1), J. Meixner (2), D. Rettenmaier (2), F. Maier (1), M. Nottebohm (1), T. Ptak (1), and M. Sauter (1)
(1) University of Göttingen, Applied Geology Dept., (2) Karlsruhe Institute of Technology (KIT), Hydrogeology Dept., Germany

Relying on the structural-hydrogeological model proposed by J. Meixner (2009) for a particular hydrothermal system in South-West Germany (on the East side of the Upper Rhine Rift, this reservoir being used to demonstrate electricity production by means of a well doublet), we set up a distributed-parameter model (using Feflow) enabling to numerically simulate fluid ages, temperature evolutions and tracer test signals for a number of contrasting assumptions w. r. to

- (a) the nature of boundary conditions and hydrogeological characteristics of remotely situated, large-scale natural faults,
- (b) the degree of permeability contrast between different system compartments,
- (c) the hydrogeological characteristics of a naturally-occurring fault, located between injection and production wells.

It appears that a spike dimensioning allowing for tracer signals to become detectable during the first three years after tracer injection in *all* of the contrasting a/b/c scenarios is not feasible in practice. In some of the a/b/c cases considered, the system will act like a very large reservoir, with fluid residence times in the order of decades, and extreme dilution of injected tracers. Even using preparative-scale cleaning of samples, brine separation, sample enrichment by solid phase extraction, evaporative concentrating etc. followed by state-of-the-art chromatography techniques to separate between tracer and natural background, it will not be possible to lower tracer detection limits below a certain threshold, which is mainly dictated by the amount of certain naturally-occurring aromatics in the reservoir fluids. On practical reasons, the spike dimensioning will be limited to some hundred kilogram of one or two organic tracers. This implies that part of the above-mentioned, contrasting a/b/c scenarios will remain indistinguishable during the first three years after tracer injection.

However, for this reservoir structure, there is not a bijective correspondence between *early-vs.-late* appearance of tracer and *small-vs.-large* reservoir. Therefore, we further examine the questions:

- How much information will be lost, and what degree of uncertainty will affect temperature predictions, as a consequence of the chosen practical ceiling on injected tracer quantities?
- Can single-well, dual-tracer push-pull tests (to be conducted at the geothermal re-injection and/or at the geothermal production well) contribute to reducing the ambiguity of inter-well early-signal inversion?

Acknowledgement: This work pertains to a research project jointly funded by Energie Baden-Württemberg (EnBW) and by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU, project key: 0325111B), with operational support from local Energy and Water Supply Plants (EWB), from the Karlsruhe Institute of Technology (KIT, Hydrogeology Group), and from the European Institute for Energy Research (EIfER, Dr. Zorn).